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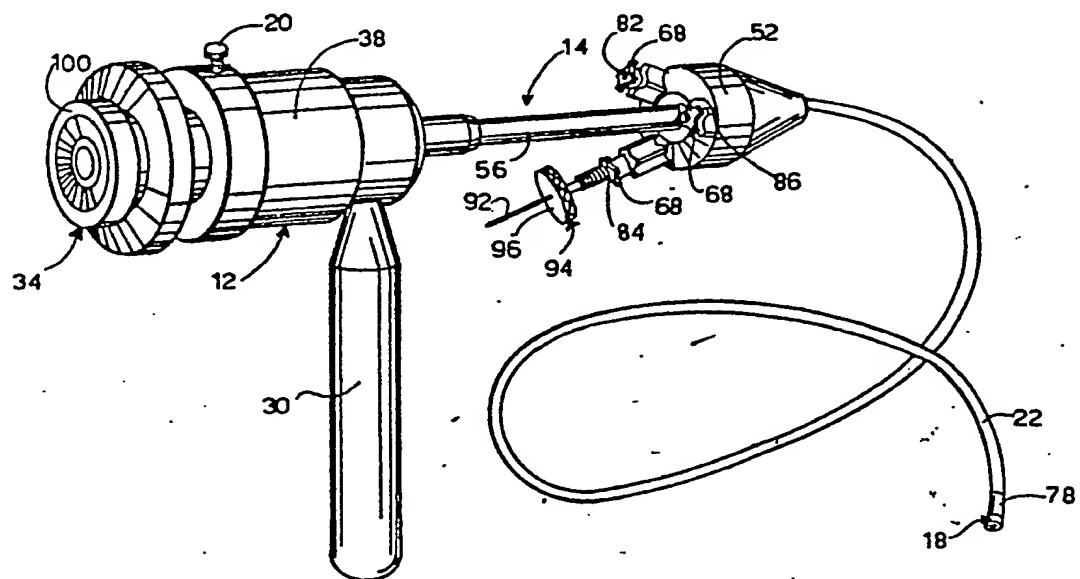
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(54) Title: **ENDOSCOPIC DEVICE HAVING HANDLE ASSEMBLY AND CATHETER ASSEMBLY**



(57) Abstract

An endoscopic device having a handle assembly (12) and a catheter assembly (14). The catheter assembly carries a viewing conduit (26) which cooperates with an eyepiece (34) on the handle assembly for viewing in a patient's body cavity. The catheter assembly is preferably rotatably and removably mounted on the handle assembly. Also disclosed is a coupling unit (231) which, together with the catheter assembly, forms an endoscopic camera device.

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ENDOSCOPIC DEVICE HAVING HANDLE  
ASSEMBLY AND CATHETER ASSEMBLY

Technical Field of The Invention

5           The present invention relates to endoscopic devices having catheter assemblies mounted on handle assemblies.

Cross Reference to Related Application

10           This application is a continuation-in-part of copending U.S. Patent Application Serial No. 549,780 filed November 8, 1983.

Background of the Invention

15           Various kinds of endoscopes are commonly used for examination and treatment within a patient's body cavity. Endoscopes generally have a tubular portion which is inserted into a patient's body cavity and a handle portion which remains outside the patient to be manipulated by a physician. The tubular portion typically carries a fiberoptic viewing bundle which cooperates with an eyepiece in the handle portion to permit viewing within the body cavity. The spacing between the end of the viewing bundle and the eyepiece must be exact for proper focus. A single optical fiber is usually also  
20           provided for illumination. Typical of such endoscopic devices are U.S. Patent Nos. 4,146,019 to Bass et al., 4,163,148 to Fritsche et al., and 3,818,902 to Kinoshita et al.

30           All of these endoscopic devices suffer from the same drawback. The tubular portion of the device which carries the fiberoptic viewing bundle is fixed on the handle portion. The entire endoscopic device must be sterilized before the tubular portion can be inserted into a patient. Because of the sensitive  
35           nature of the optics carried by the eyepiece, steam



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sterilization and immersion is not possible and ethylene oxide gas is usually used. This requires a longer sterilization time making the entire instrument unavailable for use during this time.

5           Having the tubular portion fixed on the handle portion has another disadvantage. Viewing bundles and optical fibers are rather delicate and the tubular portion is usually bent as it is inserted into the patient. This places substantial tension and compression forces on the bundle and fibers.  
10           After a substantial amount of use, many of the individual fibers making up the viewing bundle begin to break, obstructing viewing. Similarly, a single optical fiber as used for illumination can also  
15           break, preventing its use.

          Eventually the viewing bundle or optical fiber must be replaced. However, since they are fixed along their entire length within the tubular portion, removal from the tubular portion is difficult  
20           if not impossible. The tubular portion in turn is fixed on the handle portion to provide the proper spacing between the bundle end and the eyepiece. This makes replacement of a bundle even more difficult. Often, the entire device is disposed of,  
25           or requires factory service.

          Many endoscopes also include one or more channels for introducing a flushing liquid into the patient's body cavity. These flushing channels communicate with connectors mounted on the handle  
30           portion of the device adjacent the eyepiece. When there is any leakage of liquid from these channels or connectors on the handle portion, the optical system in the eyepiece can be damaged, if not destroyed.

          Another common problem with present  
35           endoscopes is that rotation of the handle portion



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also causes rotation of the tubular portion. Movement of the handle portion may be inadvertant or to provide a better grip for the physician. Rotation of the tubular portion in a body lumen can damage the lumen and move the end of the endoscope away from the tissue being studied.

It is also desirable to photograph the image seen through the endoscope to provide a record and allow for further study. The present devices are generally adapters which mount a camera on the existing eyepiece. Unfortunately, this is a rather bulky combination that can be difficult to handle. Placing an adapter on the existing eyepiece also adds additional lenses which further reduces the light transmission through the entire combination. This can limit the photography that is possible depending on the lighting conditions.

Accordingly, what is needed is an endoscopic device which allows for relatively easy replacement of a viewing conduit or optical fiber which may be damaged through use. That portion of the device which comes in contact with the patient should be separately sterilizable to avoid damage to eyepiece optics. The endoscopic device should also separate any fluid channels from the eyepiece optics to avoid damage from leakage and for ease of use. In addition, the device should minimize breakage of optical fibers from flexing and bending of the tubular portion of the device and permit rotation of the handle portion without moving the tubular portion. The present invention meets these desires.

#### Summary of the Invention

The present invention is directed to an endoscopic device for viewing and possibly treating tissue within a body cavity of a patient and to an



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endoscopic camera device for use with a camera body. The endoscopic device can be introduced into a body cavity such as a lumen, and the inside of the lumen viewed and possibly treated with laser irradiation or photographed. A clear flushing fluid may be introduced if desired.

The endoscopic device of the present invention generally includes a handle assembly and a catheter assembly. The handle assembly has an eyepiece which includes focusing optics as used in art. The catheter assembly includes a viewing conduit such as a fiberoptic viewing bundle carried by a cannula. Retaining means mounts the catheter assembly on the handle assembly with the viewing conduit operably associated with the eyepiece.

The catheter assembly is preferably rotatably and removably mounted on the handle assembly. The catheter assembly can then be easily detached and separately disinfected or sterilized without subjecting the handle assembly and eyepiece to sterilization. Alternatively, the catheter assembly can be easily replaced such as when the viewing conduit becomes damaged through use. Several catheter assemblies can be maintained sterile for use in seriatim by the same handle assembly. A rotatable mounting allows the handle assembly to be easily turned without displacing the catheter assembly and damaging tissue within the patient.

In one embodiment of the endoscopic device, a flexible light transmitting conduit such as an optical fiber is slidably received in a channel defined by the flexible cannula. This conduit can be used to transmit illuminating light or laser irradiation for use in the patient's body cavity. Locking means on the cannula fixes a portion of the



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conduit relative to the cannula. The locking means is preferably at the proximal end of the cannula outside the patient. As the cannula is twisted and bent by insertion into the patient, the remainder of the optical fiber slides relative to the cannula, thus avoiding strain or compression of the fiber. This substantially minimizes fiber breakage commonly caused by bending of the cannula.

The cannula also preferably defines one or more channels through which a flushing fluid or vacuum can be introduced. The channels communicate with respective ports mounted on the catheter assembly. Since the ports are mounted on the catheter assembly and not the handle assembly, any leakage about the ports or from the channels will not damage the eyepiece optics in the handle assembly. The catheter assembly can also be easily replaced should one of the channels become permanently clogged.

The present invention also includes an endoscopic camera device which permits either photographing or video taping within the patient's body cavity. The endoscopic camera device uses the catheter assembly as described above. However, instead of mounting the handle assembly on the catheter assembly, a coupling unit attached to a camera body is mounted on the catheter assembly. The handle assembly can first be mounted on the catheter assembly to guide the end of catheter assembly to its desired location while the operator views through the handle assembly eyepiece. The handle assembly can then be easily removed and replaced by the coupling unit to allow for photography.

The coupling unit includes a housing having a proximal end and a distal end. The distal end defines the socket which receives the catheter



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assembly. The proximal end includes mounting means for associating the coupling unit with the camera body. The camera body includes imaging means such as photographic film or a video imaging tube.

5           Because the coupling unit is mounted directly on the catheter assembly, it is not necessary for the light to also pass through the eyepiece on its way to the camera body. This reduces light loss that would be caused by the lenses in the  
10 eyepiece. Mounting the camera or camera body on the catheter assembly also becomes less bulky simplifying photography.

Numerous other advantages and features of the present invention will become readily apparent to  
15 those skilled in the art from the following detailed description of the preferred embodiment of the invention, the drawings, and the appended claims.

Brief Description of the Drawings

20           FIGURE 1 is a perspective view showing an endoscopic device of the present invention having a catheter assembly mounted on a handle assembly;

          FIGURE 2 is a side elevational exploded view, partially in section, of the endoscopic device of FIGURE 1 showing the catheter assembly separated  
25 from the handle assembly;

          FIGURE 3 is a cross-sectional view of the catheter assembly taken generally along plane 3-3 of FIGURE 2;

30           FIGURE 4 is an enlarged cross-sectional view of the catheter assembly taken generally along plane 4-4 of FIGURE 2;

          FIGURE 5 is an enlarged perspective view of the distal portion of a catheter assembly similar to that of FIGURE 1;

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FIGURE 6 is a view of the handle assembly of FIGURE 2 together with a camera adapter;

FIGURE 7 is a side elevational view, partially in section, of an alternative embodiment for the catheter assembly;

FIGURE 8 is a side elevational view, partially in section, of the proximal end of the catheter assembly of FIGURE 7;

FIGURE 9 is a side elevational view, partially in section, of the distal end of the catheter assembly of FIGURE 7; and

FIGURE 10 is a side elevational view taken in section of a coupling unit of the present invention.

Detailed Description of the Preferred Embodiments

While this invention can be embodied in many different forms, there is shown in the drawings and described in detail, preferred embodiments of the invention. The present disclosure is an exemplification of the principals of the invention and is not intended to limit the invention to the embodiments illustrated.

Referring to FIGURES 1 and 2 of the drawings, one embodiment of the present invention, an endoscopic device is shown. The device includes a handle assembly 12 and a catheter assembly 14 having a proximal portion 16 and a distal portion 18. Referring also to FIGURES 3 and 4, the catheter assembly 14 also includes a cannula 22 which defines a passageway 24 into which a viewing conduit 26 such as a coherent fiberoptic bundle 28 is received to be carried by the cannula.

Retaining means 32 are provided for mounting the catheter assembly 14 on the handle assembly 12 with the viewing conduit 26 operably associated with



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an eyepiece 34 forming part of the handle assembly. The eyepiece 34 includes proximal viewing optics 36 such as a 15x lens system commonly used in endoscopic devices and well known in the art. The eyepiece 34 is preferably adjustably mounted on body portion 38 of the handle assembly 12 to provide for focusing of the optics. This adjustment can be by screw thread or by a sliding carrier as commonly used. Once a proper focus is obtained, the eyepiece 34 can be fixed by locking screw 20.

The retaining means 32 preferably removably and rotatably mounts the catheter assembly 14 on the handle assembly 16. This allows the handle assembly 12 to be rotated for convenience of the physician without rotating of the catheter assembly 14. Alternatively, the catheter assembly 14 can be rotated as it is inserted into a body lumen without also having to rotate the handle assembly. This provides for easier optical tracking during insertion. The catheter assembly 14 can also be easily removed for separate sterilization or replacement should the viewing conduit 26 become damaged through use. The catheter assembly 14 can be sterilized by ethylene oxide gas or by immersion in a disinfectant. Only the exterior of the handle assembly 12 need be sterilized or alternatively wrapped in a sterile covering. This extends the life of the handle assembly 12 and its optics 36 and allows for faster sterilization of the catheter assembly 14.

Having the catheter assembly 14 separable from the handle assembly 12 also allows the viewing conduit 26 to be easily replaced should it become damaged through extensive use. One need only disconnect the old catheter assembly and replace it with a new catheter assembly. The retaining means 32



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will automatically align the new viewing conduit with the eyepiece 34.

The handle assembly 12 can also be provided with a handle 30 which extends transversely to the body portion 38 and hence the viewing system. The handle 30 provides a grip for the physician and gives a longer working length for the device. Unlike prior devices, no portion of the catheter assembly and viewing bundle is wasted to provide a holding surface for the physician. This is important since viewing bundles are usually limited in length and certain procedures require the device to be inserted through several arteries, such as from the leg to the heart.

The retaining means 32 preferably includes a socket 42 defined by an insert 40 of the handle assembly 12 into which the proximal portion 16 of the catheter assembly 14 is received. The socket 42 is preferably right-cylindrical in shape. The retaining means 32 can also include a detent such as a snap ring 44 carried within the socket 42. The snap ring 44 is received in a circumferential groove 46 defined by the proximal portion 16 of the catheter assembly 14. Alternatively, the snap ring can be carried by the catheter assembly 14 with the groove on the handle assembly 12. This provides for both rotation and detachable maintenance of the catheter assembly 14.

In addition to the cannula 22, the catheter assembly 14 can also include a plug 52 which is mounted on proximal end 54 of the cannula 22 vicinal or near the catheter assembly proximal portion 16. The plug 52 should be spaced from the handle assembly 12 when the catheter assembly 14 is mounted on the handle assembly. The catheter assembly 14 can also include a sleeve 56 having a proximal end 58 and a



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distal end 62 which is mounted on the plug 52. The sleeve 56 defines a bore 64 which is in fluid communication with the passageway 24 defined by the cannula 22. This provides a passageway between the proximal end 58 of the sleeve 56 through to distal end 66 of the cannula 22 to retain the viewing conduit 26. As shown, the sleeve 56 defines the groove 46 which cooperates with the detent 44. The sleeve 56 can also include an inner tube 60 which supports the viewing conduit 26 as it extends through the socket into a cavity 48 defined by the body portion 38 of the handle assembly 12.

The viewing conduit 26 is received within the bore 64 and passageway 24 defined by the sleeve 56 and cannula 22 respectfully. The viewing conduit 26, as shown, preferably terminates slightly within the inner tube 60, before the sleeve proximal end 58. This protects the end of the viewing conduit 26 from being scratched or damaged when the catheter assembly 14 is not mounted on the handle assembly 12. Right-cylindrical abutment surface 50 on the sleeve 56 cooperates with the socket 42 and retaining means 32 to ensure proper and automatic spacing between the terminus of the viewing conduit 26 and the eyepiece 34.

Referring to FIGURES 3 and 4, the cannula 22 preferably defines one or more channels. As shown in FIGURE 4, the cannula 22 defines three channels 72, 74, and 76. These channels are in fluid communication with respective ports 82, 84, and 86 mounted on the cannula by the plug 52 as shown in FIGURE 3. The channels extend at least a major portion of the length of the cannula 22 and in some cases extend between the proximal end 54 and distal end 66 of the cannula. The channels can be used for several



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purposes. They can be used to introduce a flushing fluid through the distal portion 18 of the catheter assembly 14, to allow for insertion of a medical instrument through the catheter assembly, or allow  
5 for the inflation of an expandable balloon 78 carried on the distal portion of the catheter assembly 14.

A plurality of channels can be used at the same time. For example, one channel 76 can be used to expand the balloon 78 while another, second  
10 channel 72 is used for flushing or vacuum. Spacing the ports 82, 84 and 86 away from the handle assembly 12 keeps any flushing tubes and other conduits away from the handle assembly 12, allowing easier use of the viewing system.

15 The balloon 78 is inflated by passing a fluid such as saline through channel 76. The fluid, usually 4 to 10 milliliters of saline or carbon dioxide, enters the balloon 78 through holes 88 in the side wall of the cannula. The desired inflated  
20 diameter of the balloon 78 can be determined by the volume of fluid injected. The expandable balloon 78 can be made of any suitable flexible plastic material such as silicone rubber.

Generally, a multiple lumen cannula such as  
25 cannula 22 having a plurality of lumens such as channels 72, 74 and 76 as well as passageway 24 is used. The cannula 22 can be any suitable flexible material, but polyurethane is preferred since it minimizes kinking. The cannula 22 should, at least  
30 in part, be radiopaque to permit fluoroscopic tracking. In the embodiment shown, the cannula 22 has a diameter of about 2.5 millimeters, channel 76 has a diameter of about 0.3 millimeters and channels 72 and 74 have diameters of about 0.7 to 0.8  
35 millimeters.



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The ports 82, 84, and 86 are each provided with a small metal tube 70 one end of which is connected to a fluid coupling 68 and the other end of which is inserted in an interference fit into  
5    respective channels 72, 74, and 76. The inner tube 60 forming part of the sleeve 56 is then inserted in an interference fit into the passageway 24. The viewing conduit 26 is then located in the sleeve bore 64 and passageway 24. The sleeve 56, cannula 22,  
10    couplings 68 and tubes 70 are located into a mold and the plug 52 cast about these components. An epoxy resin such as RF-5407 Resin Formulators Co., of Culver City, California has been found to be a satisfactory material for molding the plug 52. Other suitable  
15    molding materials can also be used. Any leakage of liquid from a port or channel will not damage the optics 36 carried by the handle assembly 12. Since the openings from ports 82, 84 and 86 through the channels 72, 74 and 76 are relatively straight, the  
20    channels can be easily unclogged with a wire if necessary.

As shown, channel 76, which can be relatively small, is in fluid communication with the expandable  
25    balloon 78 and port 86. For ease of use, port 86 can be provided with fluid coupling 68 such as a Luer-Lok commonly used in the art. Channels 72 and 74, as shown, open through the distal end 66 of the cannula. The port 82, in fluid communication with  
30    channel 72, is also provided with a fluid coupling 68 for connection with a fluid source or vacuum source. This allows for the introduction of a clear flushing fluid to improve viewing within the body cavity or for the removal of debris. A small medical instrument can also be introduced through channel 72  
35    or 74. Channel 72 or 74 can also be used with a



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guide wire (not shown) to guide the catheter assembly distal portion 18 to a site in a lumen. In large lumens an external guide catheter can be used.

Channel 74 carries a flexible light transmitting conduit which can be either a coherent viewing bundle or as shown, a single optical fiber 92. Optical fiber 92 is slidably received in channel 74 such that it is free for relative movement. As shown in FIGURE 1, locking means 94 is provided on port 84 by being mounted on fluid coupling 68 to fix a portion of optical fiber 92 relative to a portion of the cannula 22 e.g., that portion surrounded by the plug 52. For clarity, the locking means 94 is not shown in FIGURE 3, but is to be received on port 84.

After optical fiber 92 is inserted into the channel 74 and positioned as desired, the locking means 94 then fixes that portion of the fiber 92 adjacent the locking means. The locking means 94 can be a collapsible collar arrangement such as deformable ring using a hollow thumb nut 96. The deformable ring such as a rubber "O" ring is received within the threaded fluid coupling and the optical fiber 92 threaded through the thumb nut 96, "O" ring and coupling. As the thumb nut 96 is tightened, the ring is compressed to hold the optical fiber 96. Since the ring is deformable and preferably of a relatively soft material such as a rubber, the optical fiber can be removably fixed without fear of damage. Alternatively, a portion of the fiber 92 can be fixed on the cannula distal end 66 with glue or other binder as the locking means. As the flexible cannula 22 is bent into various curves, that portion of the optical fiber 92 which is not fixed is free to slide relative to the cannula 22. This avoids the



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strain and compression common in prior art devices which often destroys the fiber.

In use, the fiber 92 can serve two purposes. It can be connected to a conventional light source to illuminate the body cavity for viewing through conduit 26. Optical fiber 92 can also be used to transmit laser irradiation through the catheter assembly 14. The catheter assembly 14 is then positioned within the patient's body cavity, aimed using the viewing conduit 26, and laser light transmitted through the conduit 92 to alter or remove tissue. Where a viewing conduit is used in place of the optical fiber 92, distal focusing optics can be mounted on the distal end of the viewing conduit so the conduit can move within the cannula 22 and maintain proper spacing with the distal focusing optics.

The viewing conduit 26 is preferably a fiberoptic viewing bundle 28 carried by the sleeve 56 and cannula 22. The cannula distal end 66 is provided with an appropriate distal focusing lens as known by art. Alternatively, the viewing conduit can be a GRIN system, a thick lens system, or any other suitable system used in the endoscope art. The viewing fiberoptic bundle 28 can be either a coherent glass bundle or alternatively a coherent plastic fiber bundle. The latter is preferred since it is relatively less expensive and allows the entire catheter assembly 14 to be disposable.

The design for the distal portion 18 of the catheter assembly 14 can best be seen in FIGURE 5. The shape of the channels 72 and 74 maximizes fluid flow. The distal portion 18 is provided with a GRIN lens 90 mounted in passageway 24 of the cannula. The GRIN lens 90 is chosen and spaced from the viewing bundle 28 to provide for a desired minimum focal





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length and field of view. In the device shown, the field of view in air is about 55 degrees and the minimum focal length is about 4 millimeters.

5 The handle assembly 12 is preferably made of a rigid material such as metal or a rigid plastic. The sleeve 56 is also preferably made of a metal such as stainless steel or aluminum. The sleeve bore 64 is then aligned with the cannula passageway 24 and the plug 52 molded about the sleeve distal end 62 and  
10 cannula proximal end 54.

Referring to FIGURE 6, an adapter 98 can be provided for attaching the device to a television or photographic camera (not shown). The adapter includes an appropriate lens as known in the art.  
15 The adapter 98 is mounted on the eyepiece 34 of handle assembly 12 by spring loaded ball bearings within the adapter which coact with flange 100 on the eyepiece 34. The lens of the camera is then mounted on the adapter 98 and the image televised or  
20 photographed as desired.

An alternative preferred embodiment for a catheter assembly 114 is shown in FIGURES 7 through 9. The catheter assembly 114 has a proximal portion 116 and distal portion 118. In this embodiment,  
25 cannula 122 of catheter assembly 114 is designed to be relatively small in diameter, about 1.7 millimeters. As before, the cannula 122 is associated with sleeve 156 by plug 152. The sleeve 156 having tube 157 on distal proximal portion 116 is  
30 much as before. The sleeve 156 includes groove 146 which cooperates with the detent on the handle assembly 12.

The viewing conduit 126 includes viewing fiber optic bundle 128 which extends through the  
35 cannula 122 and the sleeve 156. Also provided are



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light transmitting or illumination fibers 180 which extend through the cannula 122, and exit through port 182 mounted on the plug 152. A metal tube 155 carries the optics through the plug 152. The illumination fibers 180 are connected by conduit 192 to coupling 181 for attachment to an appropriate light source such as a high intensity light. The coupling 181 is provided with appropriate retaining means such as groove 183 on proximal end 185 of the coupling.

Referring also to FIGURE 9, the illumination fibers 180 are shown carried by the cannula 122 about the viewing fiber optic bundle 128. A plurality of illumination fibers 180, in design shown, six such fibers, surround the viewing fiber optic bundle 128. The fibers are preferably evenly spaced about the bundle 128.

A lens 190, preferably a GRIN lens is mounted on the distal portion 118 of the cannula 122 and operably associated with the viewing bundle 128. The illumination fibers 180 extend about the lens 190 and are coterminous with the lens to provide direct emission of light beyond the distal end 118 of the cannula. This design is particularly advantageous since it allows for the construction of a relatively small diameter catheter assembly. The lens 190 is preferably associated with the fiber optic viewing bundle 128 by a ferrule assembly 179 which fixes the relationship of the lens and bundle.

In constructing the cannula and viewing system shown in FIGURE 9, the viewing bundle 128 and the illumination fibers 180 are inserted through a tube 123. A two-sleeved ferrule assembly 179 is then placed over the end of the viewing bundle 128 to fix the lens 190 with respect to the viewing bundle. As

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can be seen in FIGURE 9, protective cladding 177 about the illumination fibers 180 is stripped away from that portion of the fibers that extend around the ferrule assembly 179 and lens 190 to minimize the overall diameter of the distal end 118.

5 In the preferred arrangement, six illumination fibers 180 are located evenly spaced about the viewing bundle 128 and lens 190. The distal end 118 is then filled with an epoxy 175 to seal the distal end with the illumination fibers 180 circling about the lens 190. Using a viewing fiber optic bundle of 0.75 millimeters, the result is a catheter assembly 114 which provides for viewing and illumination while only occupying a diameter of 1.7 millimeters. The catheter assembly 114 can also be pre-formed, that is the cannula 122 can be given a particular shape such as by placing a bendable wire within the cannula. In use the cannula 122 can be inserted into the patient through a guide catheter to provide access and a passageway for a clear flushing fluid such as saline to improve viewing.

Referring to FIGURE 10, a coupling unit 231 of the present invention is shown. The coupling unit 231 can be used with either catheter assembly 14 or 114 to form an endoscopic camera device to be associated with a camera body (not shown). The camera body contains imaging means such as photographic film or a video tube. The coupling unit 231 can either be attached to the camera directly or attached to the camera body through the lens forming part of the camera.

The coupling unit 231 includes a housing 233 having a proximal end 235, a distal end 237 and defining a cavity 239. The distal end 237 defines a socket 242 having the same general configuration as



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the socket described above for the handle assembly 12. The retaining means can be the same as for the handle assembly 12 including a snap ring 244 within the socket which cooperates with the groove 46 on the catheter assembly 14. As shown, the socket 242 is defined by an insert 240 and the socket is generally right cylindrical. Lock means in the form of a thumb screw 241 is also provided to retain the coupling unit 231 on the catheter assembly 14.

On the proximal end 235 of the coupling unit 231 there is a mounting means for associating the unit with the camera body. The mounting means can be a standard camera screw thread 243 that is protected by a lens cap 245 when the unit is not in use. The socket 242 is similarly protected by a cap 247 when not in use.

The coupling unit 231 also preferably includes optics 249 carried within the cavity 239 on carriage 259 fixed with respect to main tube 251 by set screw 257. The optics 249 enlarge and focus the image on the imaging means carried by the camera body. To allow for adjustable focusing, means are preferably provided for varying the distance between the optics 249 and the socket 242. This is best done by having the housing 233 constituted by the main tube 251, a proximal tube 253 and a distal tube 255. The distal tube 255 is movably mounted on the main tube 251. This movable mounting can be accomplished either by slidably mounting as shown or by appropriate interrelating screw threads as is well known in the art.

In use, the physician uses the catheter assembly 14 and handle assembly 12 to guide the distal end 18 of the catheter assembly to an appropriate location in the patient's body cavity.



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Once the distal end 18 of the catheter assembly 14 is properly located, the physician can then easily remove the handle assembly 12 from the catheter assembly 14 and replace it with the coupling unit 231. The coupling unit 231 can be premounted on the camera body. It then becomes possible to either video tape or photograph the desired part of the patient's body cavity.

Because the coupling unit 231 does not operate through the eyepiece 34 of the handle assembly 12, there is a minimum amount of light loss. The coupling unit 231 and camera body are also easier to handle since the handle assembly 12 is not present. The relative ease of the interchangeability between the coupling unit 231 and the handle assembly 12 is a particular advantage of the present invention.

The coupling unit 231 can also be provided pre-focused and sterile thus avoiding the necessity of a sterile bag which can hamper use. Two or more coupling units 231 can also be used alternatively, one attached to a video camera for viewing by several people and the other attached to a still camera to document the view.



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## WHAT IS CLAIMED IS:

1. An endoscopic viewing device comprising:
  - a) a handle assembly including an eyepiece;
  - 5 b) a catheter assembly having a proximal portion and a distal portion, the catheter assembly including a cannula and a viewing conduit carried by the cannula; and
  - 10 c) retaining means for rotatably mounting the catheter assembly on the handle assembly with the viewing conduit operably associated with the eyepiece.
2. The endoscopic viewing device of claim 1 wherein the retaining means includes a socket  
15 defined by the handle assembly with the proximal portion of the catheter assembly being received in the socket.
3. The endoscopic viewing device of claim 2 wherein the retaining means further includes  
20 a detent carried by the handle assembly which is received in a groove defined by the proximal portion of the catheter assembly.
4. The endoscopic viewing device of claim 1 wherein the catheter assembly further includes a  
25 port mounted on the cannula, the cannula also defining a channel in fluid communication between the port and the distal portion of the catheter assembly.
5. The endoscopic viewing device of claim 4 wherein the port is vicinal the proximal portion of  
30 the catheter assembly.
6. The endoscopic viewing device of claim 4 including an expandable balloon on the distal portion of the catheter assembly, the channel being in fluid communication with the balloon.

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7. The endoscopic viewing device of claim 6 including a second port mounted on the cannula and a second channel defined by the cannula, the second channel being in fluid communication with the second port and opening through the distal portion of the catheter assembly.

8. The endoscopic viewing device of claim 7 wherein the second port includes a fluid coupling.

9. The endoscopic viewing device of claim 4 further including a flexible light transmitting conduit slideably received in the channel and locking means on the cannula for fixing a portion of the light transmitting conduit.

10. The endoscopic viewing device of claim 9 wherein the light transmitting conduit is an optical fiber.

11. The endoscopic viewing device of claim 1 wherein the viewing conduit is a coherent fiberoptic bundle.

12. The endoscopic viewing device of claim 1 wherein the catheter assembly is removably mounted on the handle assembly.

13. The endoscopic viewing device of claim 1 further including a plurality of light transmitting fibers carried by the cannula about the viewing conduit.

14. An endoscopic viewing device comprising:

a) a handle assembly including an eyepiece; and

b) a catheter assembly having a proximal portion and a distal portion; the catheter assembly including a cannula defining a channel, a viewing conduit carried by the cannula, and a plug mounted on the cannula and having a port; the channel in fluid communication between the port and the



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distal portion of the catheter assembly; the catheter assembly removably mounted on the handle assembly with the viewing conduit operably associated with the eyepiece.

- 5           15. An endoscopic viewing device of claim 14 including an expandable balloon on the distal portion of the catheter assembly with the channel in fluid communication with the balloon.
- 10           16. The endoscopic viewing device of claim 14 wherein the catheter assembly is rotatably mounted on the handle assembly.
- 15           17. The endoscopic viewing device of claim 14 further including a flexible light transmitting conduit slideably received in the channel and locking means on the plug for retaining a portion of the light transmitting conduit fixed with respect to the plug.
- 20           18. The endoscopic viewing device of claim 17 wherein the light transmitting conduit is an optical fiber.
19. An endoscopic viewing device comprising:
- a) a handle assembly including an eyepiece, the handle assembly also defining a socket;
- 25                  b) a flexible cannula having a proximal end and a distal end and defining a passageway and channel between the ends;
- c) a plug mounted on the cannula proximal end and having a port in fluid communication with the channel;
- 30                  d) a sleeve having a proximal end and a distal end and defining a bore between the ends, the sleeve being mounted on the plug with the bore in fluid communication with the cannula passageway;
- e) a coherent fiberoptic viewing bundle received in the passageway and bore;
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f) a flexible light transmitting fiber slidably received in the channel through the port;

5 g) locking means carried by the plug for fixing a portion of the light transmitting fiber with respect to the plug; and

h) retaining means for rotatably and releasably mounting the sleeve proximal end in the socket with the viewing bundle operably associated  
10 with the eyepiece.

20. The endoscopic viewing device of claim 19 wherein the handle assembly includes a body portion retaining the eyepiece, and a handle; the handle being transverse to the body portion.

15 21. An endoscopic device comprising:

a) a flexible cannula having a proximal end and a distal end and defining a channel along at least a major portion of its length;

20 b) a flexible light transmitting conduit slideably received in the channel; and

c) locking means for fixing a portion of the conduit relative to the cannula.

22. The endoscopic device of claim 21 further including a sleeve mounted on the cannula proximal end and a handle assembly releasably mounted  
25 on the sleeve.

23. The endoscopic device of claim 22 wherein the light transmitting conduit is a coherent fiberoptic viewing bundle.

30 24. The endoscopic device of claim 23 wherein the handle assembly includes an eyepiece which cooperates with the viewing bundle carried by the cannula.

35 25. The endoscopic device of claim 21 further including a plug mounted on the cannula and



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defining a port, and the conduit also defining a second channel in fluid communication between the port and the cannula distal end.

26. A catheter assembly for use with a handle assembly or a camera coupling device defining a socket, the catheter assembly comprising:

- a) a flexible cannula having a proximal end and a distal end and defining a passageway between the ends;
- b) a sleeve having a proximal end and a distal end and defining a bore between the ends, the distal end of the sleeve being associated with the cannula with the bore substantially aligned with the passageway, the proximal end of the sleeve being adapted to be removably received by the socket;
- c) a coherent fiberoptic viewing bundle received in the passageway and bore; and
- d) a flexible light transmitting fiber carried by the cannula.

27. The catheter assembly of claim 26 further including a channel defined by the cannula and a plug mounted on the cannula proximal end and having a port in fluid communication with the channel.

28. The catheter assembly of claim 27 wherein the light transmitting fiber is received in the channel.

29. The catheter assembly of claim 28 further including locking means on the plug for retaining a portion of the light transmitting fiber fixed with respect to the plug.

30. The catheter assembly of claim 26 including a plurality of light transmitting fibers carried by the cannula about the viewing conduit.

31. The catheter assembly of claim 30 including a lens carried by the distal end of the



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cannula and operably associated with the viewing conduit; the light transmitting fibers extending about the lens.

32. An endoscopic camera device comprising:

- 5           a) a coupling unit including a housing having a proximal end and a distal end with a socket defined by the distal end, the unit also including mounting means on the proximal end for associating the unit with a camera body containing  
10       imaging means;
- b) a catheter assembly having a proximal portion and a distal portion, the catheter assembly including a cannula and a viewing conduit carried by the cannula; and
- 15       c) retaining means for removably mounting the catheter assembly on the socket with the viewing conduit operably associated with the imaging means.

20       33. The endoscopic camera device of claim 32 wherein the catheter assembly further includes a port mounted on the cannula, the cannula also defining a channel in fluid communication between the port and the distal portion of the catheter assembly.

25       34. The endoscopic camera device of claim 32 wherein the port is vicinal the proximal portion of the catheter assembly.

30       35. The endoscopic camera device of claim 32 including an expandable balloon on the distal portion of the catheter assembly, the channel being in fluid communication with the balloon.

35       36. The endoscopic camera device of claim 32 further including a flexible light transmitting conduit slideably received in the channel and locking means on the cannula for fixing a portion of the light transmitting conduit.



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37. The endoscopic camera device of claim 32 including optics carried by the coupling unit.

38. The endoscopic camera device of claim 37 including means for varying the distance between the optics and the socket.

39. A camera coupling unit for use with a catheter assembly carrying a viewing conduit, the device comprising:

a) a housing having a proximal end and a distal end and defining a cavity, the housing also defining a socket on the distal end adapted to removably receive the catheter assembly, and means for mounting the housing on a camera body on the proximal end of the housing; and

b) optics mounted within the cavity for operably associating the viewing conduit with imaging means carried by the camera body.

40. The coupling device of claim 39 including lock means carried by the housing for retaining the catheter assembly in the socket.

41. The coupling device of claim 39 wherein the housing includes a main tube and a distal tube, the distal tube being movably mounted on the main tube.



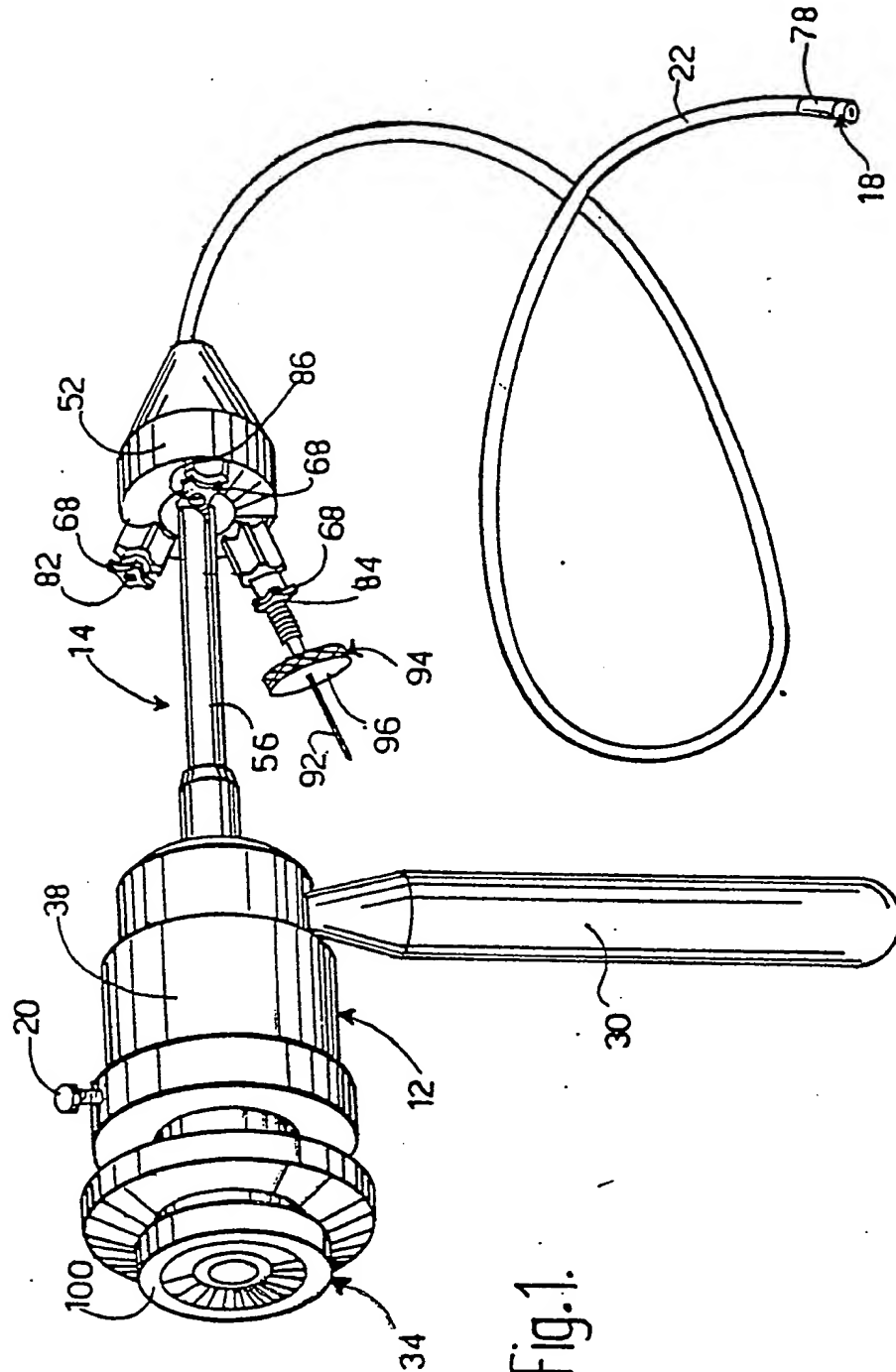
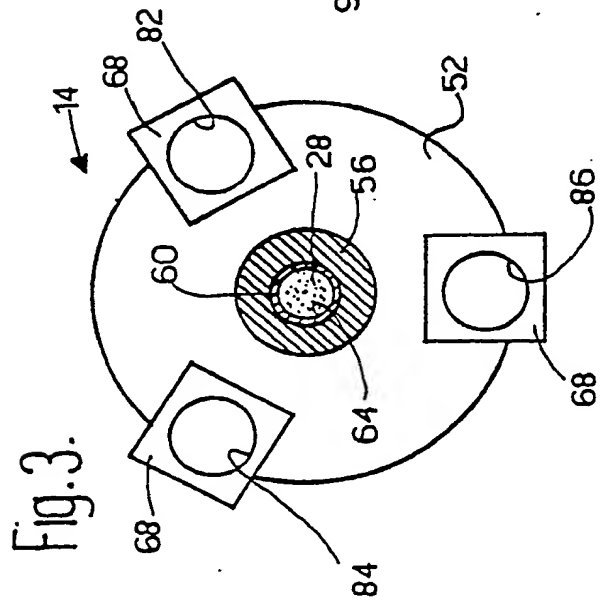
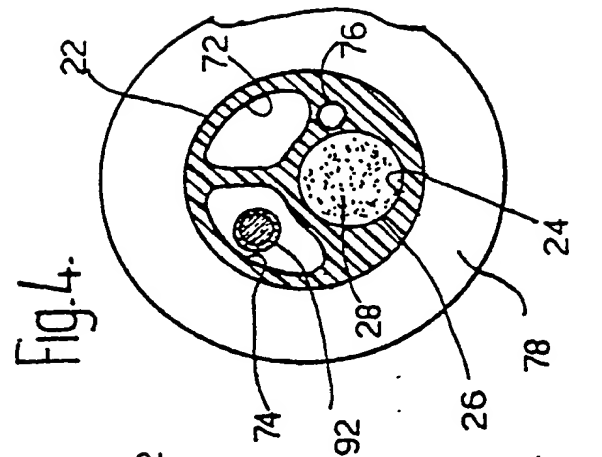
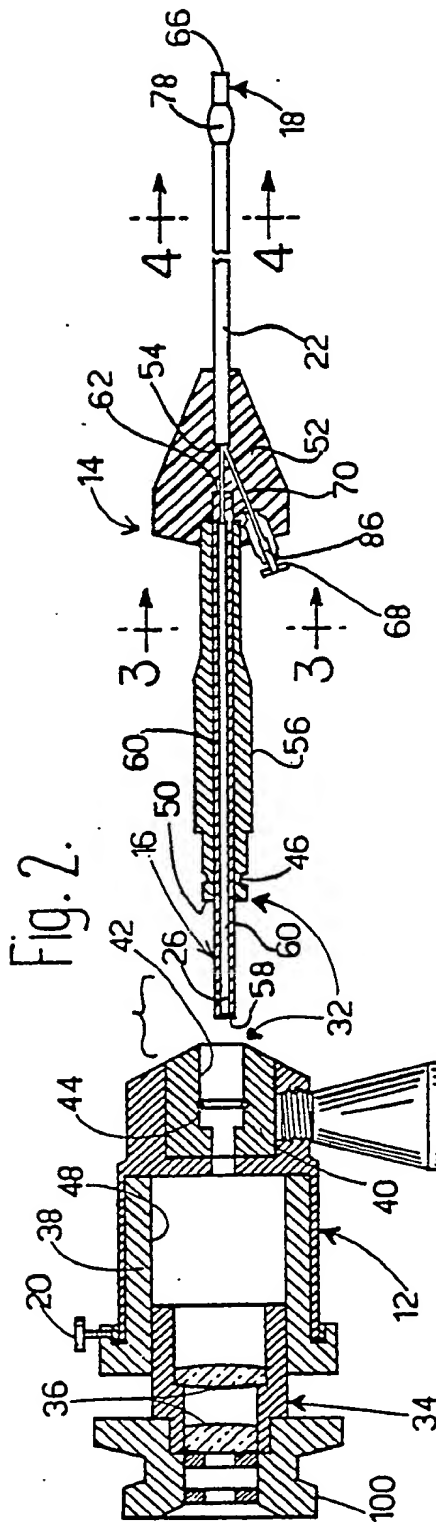


Fig. 1.

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Fig.5.

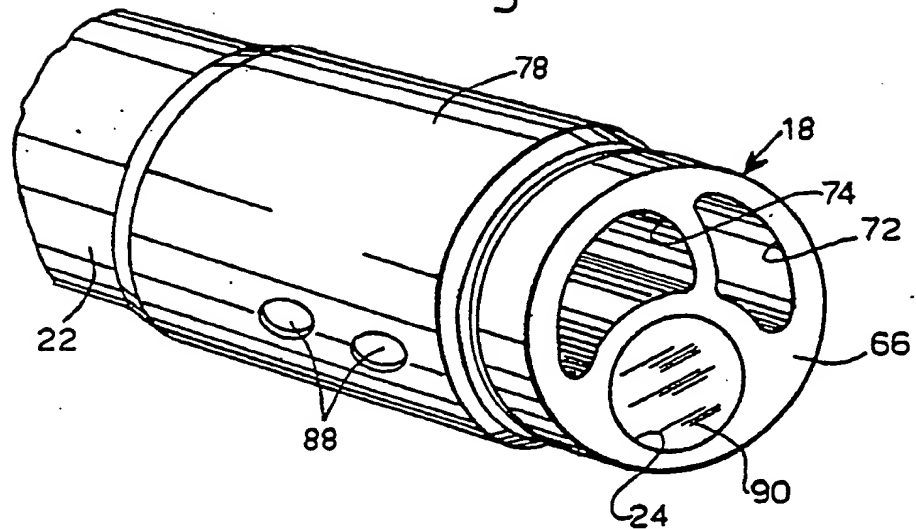
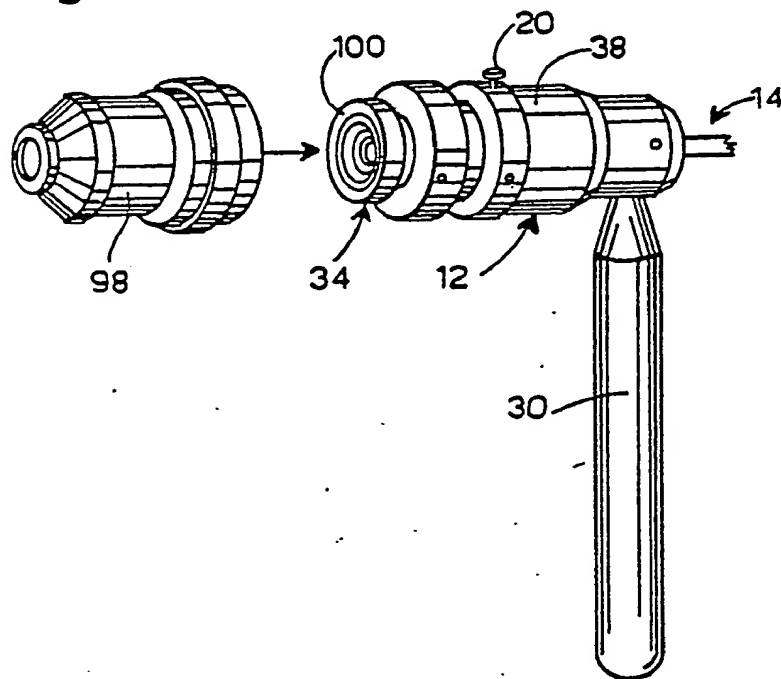


Fig.6.



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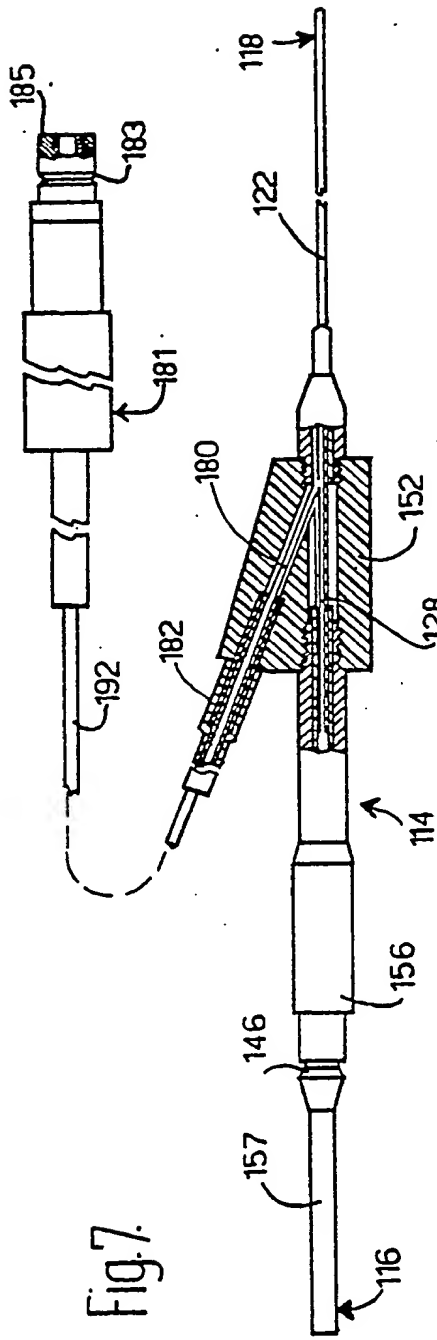
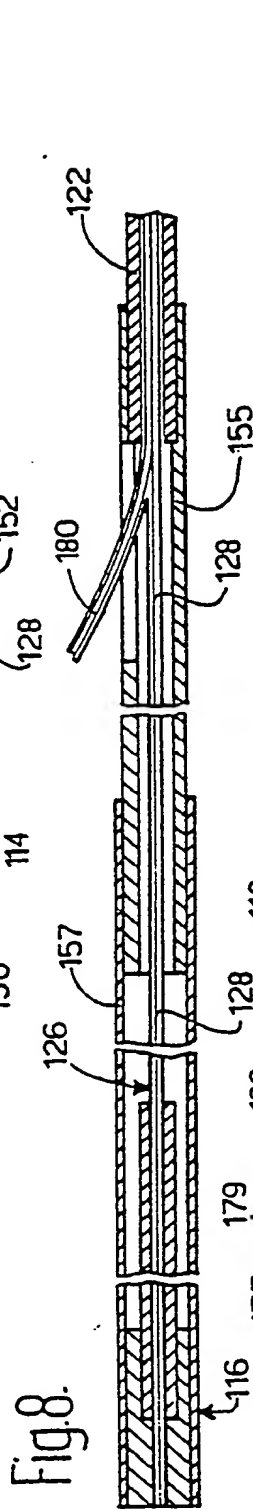


Fig. 7.



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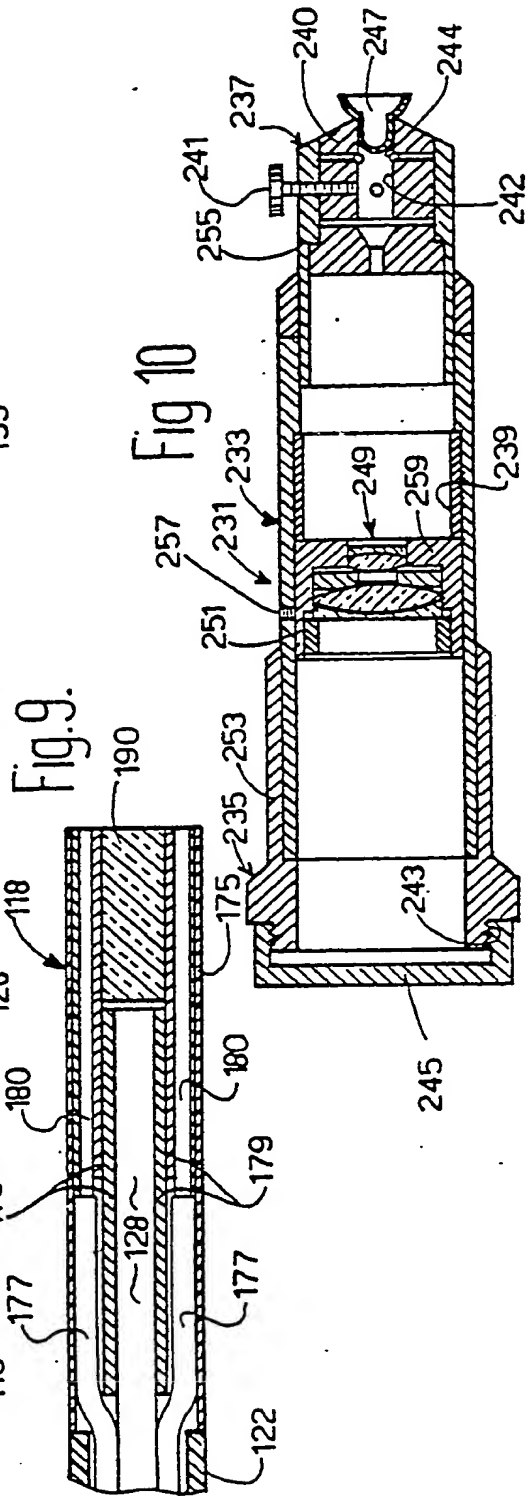


Fig 10

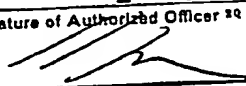
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# INTERNATIONAL SEARCH REPORT

International Application No PCT/US84/01808

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
U.S. CL. 128/4		
INT. CL. A61B 1/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
U.S.	128/4-8,11,303.1	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>5</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>6</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
Y	US, A, 3,071,129 1 January 1963 WASSERMAN	1-5,12,14,16 19-22,24-27 33,35
Y	US, A, 4,076,018 28 February 1978 HECKELE	10,11,13,18 19,21,23,26 30,31,38,41
Y	US, A, 3,005,452 24 October 1961 PITMAN	9,17,19,21, 26,28,29,36 7,8
Y	US, A, 2,691,370 12 October 1954 WALLACE	6,15,35
Y	US, A, 4,040,413 9 August 1977 OHSHIRO	32,37,39,40
Y	US, A, 4,157,216 5 June 1979 PLUMMER	
<p>* Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>1</sup>	Date of Mailing of this International Search Report <sup>2</sup>	
4 January 1985	16 JAN 1985	
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>12</sup>	
ISA/US		

Form PCT/ISA/210 (second sheet) (October 1981)

The Day of the Dragon